Montenegrin Journal of Economics

Vol. 12, No. 4 (2016), 65-75

Change of National Intellectual Capital in EU Countries

IRENA MAČERINSKIENĖ[1], JOGAILA MAČERINSKAS[2], and RASA ALEKNAVIČIŪTĖ[3]

[1] Professor dr. Mykolas Romeris University, Institute of Economics, Vilnius, Lithuania, e-mail: irena.macerinskiene@mruni.eu
[2] Assoc. Professor dr. Mykolas Romeris University, Institute of Finance, Vilnius, Lithuania
[3] Doktorate student, Mykolas Romeris University, Institute of Economics, Vilnius, Lithuania

ARTICLE INFO

Received June 07, 2016
Received in revised from August 05, 2016
Accepted November 27, 2016
Available online December 15, 2016

JEL classification:

034, 030, F02

DOI:

10.14254/1800-5845/2016.12-4.6

Keywords:

national intellectual capital,
human capital,
social capital,
structural capital,
relational capital

ABSTRACT

The importance of national intellectual capital is widely recognized, however it is difficult to define the value of these resources. In this paper the value of national intellectual capital in EU countries and its change is analysed. The aim of the analysis is to show how the level of national intellectual capital changes in EU countries and what the main sources of this change are. Firstly, the concept of national intellectual capital is described. Secondly, national intellectual capital measurement capabilities are analysed, and a model for measuring national intellectual capital is proposed. The proposed measurement model combines two indicators values aggregation functions: refined methods of factor scores and a non-refined method (SAW). This model is applied to evaluate the level of national intellectual capital in EU countries during the period of 2002-2012. The findings have shown that the level of national intellectual capital increased in all analysed EU countries except Finland. The growth was mainly influenced by the growth of human capital and structural capital, though the level of social capital has decreased in many countries during this period. The growth of national intellectual capital was lower in countries, which initially had higher levels of intellectual capital; and this finding shows that national intellectual capital converges between EU countries.

INTRODUCTION

Innovative capabilities and national intellectual capital becomes main sources of competitiveness (Andriessen 2005, Taranenko 2013, Krušinskas, Bruneckienė, 2015). The concept of intellectual capital offer some alternatives to tangible resources, as they are not consumed when applied to value-creation processes (Bornemann 2012). Due to this national intellectual capital is the only resource which could sustain long term economic growth. Another feature of intellectual capital which highlights its importance for competitive advantage is its heterogeneity and immobility. National intellectual capital is considered to be bound to spatial environment and hardly transferred or changed. Malmberg and Maskell (2005) analyse influence of geo-

graphical proximity to knowledge creation and diffusion and shows processes which helps to maintain intellectual capital level in specific territorial unit. Finding such capabilities which can differentiate country in the global economy and measurement of those capabilities is important tool for strategic management. Scientists highlight importance of different capabilities: internal technological innovation capabilities (Lahovnik, Breznik 2014), human capital (Gižienė, Simanavičienė, 2012; Tabellini, 2010), knowledge spillovers fostered by international relations (Keller, 2009), social capital (Agénor, Dinh, 2013; Hall, Lerner, 2010), institutions (Grootaert ir kt., 2008), advanced information communication technologies (Vu, 2011; Erumban, Das, 2016) etc. Though, complex complex national intellectual capital research is rare as most of researches specialize on one component of national intellectual capital. The importance of the research of intellectual capital is widely recognized. Scientists are working on theoretical models of intellectual capital development (Edvinsson and Malone 1997; Malhotra 2000, 2003), improving the methodology for measuring intellectual capital (Andriessen and Stam, 2005; Hervas-Oliver and Dalmau-Porta, 2007; Lin and Edvinsson, 2011; Beskese et al., 2014; Bontis, 2004; Bučas et al., 2012) and showing the potential intellectual capital for creating the value added (Pulic 2004). However most of research efforts are given to investigate company level intellectual capital and separate national intellectual capital components. In this article national intellectual capital in EU countries is investigated as whole construct. The aim of this research is to show how the level of national intellectual capital changes in EU countries and what the main sources of this change are.

The objectives are as follows: 1) to present a conceptual framework of national intellectual capital, 2) to investigate approaches for measuring national intellectual capital and to propose a model for measuring national intellectual capital, 3) to analyse the level of national intellectual capital in EU countries and its change during the period of 2002-2012. The research methods used include scientific literature analysis, which was used to investigate the concept of national intellectual and its measurement models. Expert survey was used to evaluate the importance of the components of national intellectual capital. The Kendall's coefficient was calculated to test agreement of expert rankings. Exploratory factor analysis, calculation of factor scores using regression factor scores function and SAW index calculation method were used to calculate the value of national intellectual capital in EU countries. The Cronbach alpha coefficient was used to test the reliability of the national intellectual capital measurement model. Descriptive statistic methods and graphical data visualization methods were used to analyse and present research results.

1. THE CONCEPT OF NATIONAL INTELLECTUAL CAPITAL

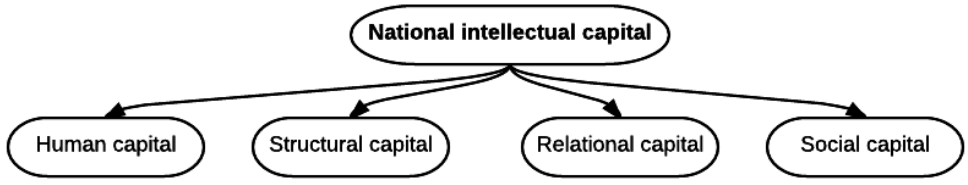
The term intellectual capital emphasizes the importance of knowledge resources. Firstly, this concept was developed in on the micro level of research, where intellectual capital is recognized as a successful social construct holistically explaining the differences and shifts in the performance of the organization (Anskaitis et. al. 2006). Currently research focus shifts from intellectual capital within a firm to a longitudinal focus of how intellectual capital is utilised to navigate the knowledge created by countries, cities and communities (Serenko et. al, 2010; Dumay and Garanina, 2013). Intellectual capital is analysed in a more holistic approach not only as a companies' asset bound in business relations and environment, but also as intellectual capital of a community, which is bound in relational and/or territorial proximity. As a consequence of this trend the concept of national intellectual capital was developed. National intellectual capital is described as "all intangible resources available to a country or region, that give relative advantage, and which in combination are able to produce future benefits" (Andriessen and Stam, 2005). National intellectual capital is viewed as an essential element of wealth creation (Bontis, 2004), as a source of competitive advantage and a factor determining future growth potential (Lin and Edvinsson, 2011), as a resource empowering economic, social and environmental development (Salonius and Lönnqvist, 2012). The importance of national intel-

lectual capital is widely understood, but the nature of national intellectual capital is difficult to describe. Due to the complexity of the concept national intellectual capital is often characterized by its structure.

There are several national intellectual capital structural models. Firstly, the intellectual capital model of Scandia Navigator, proposed by Edvinsson and Malone (1997), is often applied for the analysis of national intellectual capital (Bontis, 2004; Lin and Edvinsson, 2011; Malhotra, 2000, 2003, Užienė, 2014, Beskese et.al. 2014, Stahle et. al. 2015); also the classification system of Stewart (1997) is used (Andriessen and Stam, 2005; Buračas, 2007; Stam and Andriessen, 2009; Buračas at. al 2012). The intellectual capital model of Scandia Navigator provides hierarchical structure of intellectual capital components. In this structural model, firstly, intellectual capital is divided into human and structural capital, then structural capital further divided into market capital and organizational capital and lastly organizational capital is divided into renewal capital and process capital. Such hierarchical structure helps to reveal different importance of component capital types to final value of national intellectual capital. It is enough to measure four type of capitals (human, market, renewal and process) in order to evaluate national intellectual capital.

Intellectual capital classification system of Stewart (1997) defines three components: human capital, structural capital and relational capital. Importance of those components to final value of intellectual capital needs to be investigated further. Once applied to measure countries intellectual capital system of Stewart (1997) gives too much importance to relational capital as this component is not so important for a country as it is for a company. These two classification systems were initially created for the analysis of business intellectual capital and later applied to the national level research. However scientists highlight a need to reconsider the suitability of these models to analyse national intellectual capital (Malhotra, 2003). It is argued that national the specificity of intellectual capital might not be revealed by models created to explain business resources. Recently a new structural model of national intellectual capital was proposed by (Kapyla et al., 2012), which was created especially for the macro level research. This model extends the Stewart's (1997) model of three components by adding one new component – social capital (see Fig. 1).

Figure 1. The structure of national intellectual capital



Source: Kapyla et al., 2012.

National intellectual capital is divided into four parts: human capital, structural capital, relational capital, and social capital.

- Human capital represents knowledge, education and competencies of individuals in realizing national tasks and goals (Bontis, 2004).
- Structural capital is intellectual capital hidden in national organizational and technological structures (Malhotra, 2000). This capital consists of R&D and innovation systems, scientific and information communication technologies infrastructure. B. Batog and J. Batog (2015)

shows that R&D spending is strongly related to the technological innovations and technological spillovers and is important source of economic growth.

- Relational capital is a national asset hidden in a country's international relations. It shows a country's competitiveness in the external market, which is achieved by investments in foreign relations and exports of quality products and services (Bontis, 2004).
- Social capital refers to institutions, relations and norms, which compose quality and quantity of social interactions in specific society (Jianbin et al., 2014).

Incorporation of social capital into the structure of national intellectual capital reduces the scope of structural capital. Structural capital in the model of Scandia Navigator and Stewart (1997) described both internal relations, organizational and technological structures. Once social capital becomes an independent component of intellectual capital, the concept of structural capital becomes narrower and describes the level of innovative infrastructure, but not the level of relational quality and quantity. Also the exclusion of social capital helps to keep external and internal relationships separate, the first described by social capital and the latter described by the term of relational capital. Kapyla et al. (2012) shows how the concepts of social capital and intellectual capital integrate together and in doing so enrich the research of national intellectual capital. Due to these reasons, the structural model of national intellectual capital proposed by Kapyla et al. (2012) was chosen as a basis for a measurement model.

2. NATIONAL INTELLECTUAL CAPITAL MEASUREMENT METHODOLOGY

The evaluation of national intellectual capital is a difficult task as there are no measurable metric parameters, which would allow us to measure this object directly (Užienė, 2010). Instead measurements are based on indirect indicators, which describe intellectual capacities, competences and complexities of structure and relationships, etc. (Koch, 2011). The value of national intellectual capital is aggregated from values of indicators, which can be measured directly. Such approach is often used to evaluate abstract concepts such as competitiveness (Bruneckiene et. al. 2012), quality of life (Rakauskienė, Lisauskaitė 2009, Beslerova, Dzuričkova 2014), leading economic properties (Pilinkus, Neimontaite 2013). While using this measurement approach the subjectivity of measurement arises in two areas. Firstly, the value of national intellectual capital will depend on indicators selected to measure each concept. Indicators, which can be used to measure each concept, are not defined, and researchers use different indicators to measure the same concept. This happens due to the fact that measurement models are adjusted to a specific country or a group of countries; also the selected indicators represent the most important aspects of the time period when the measurement was taken. Characteristics of national intellectual capital and their importance changes with the level of development of a country, so naturally the used measures need to be adapted to track them.

Secondly, the final result is highly dependent on the aggregation function chosen to summarize the values of separate indicators into one value of national intellectual capital. Most often national intellectual capital measurement models use non-refined factor scores computation methods: the Simple Additive Weighting (SAW) method (Beskese et al., 2014; Bontis, 2004; Užienė, 2014), the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) (Balcerzak, 2016) or a sum of scores by factor (Lin and Edvinsson, 2011). Once using these methods it is very important to consider the weights of each component indicator. Indicators do not have the same importance, and also the additive rule is sometimes criticized due to its inability to track the multiplying effect of different intellectual capital components. In order to minimize the negative consequences arising from the use of non-refined factor scores computation methods scientists summarize the values of indicators depending on the hierarchical structure of national intellectual capital. Firstly, indicators are summarized into defined intellectual capital components and later these components values are aggregated into one intellectual capital value. At this point the choice of the structural model of intellectual capital becomes very im-

portant, because the weights of indicators for the final national intellectual capital value depend on this model. The structural model of national intellectual capital helps to control the weights of defined structural component factors, but it does not solve the problem of how the value of structural components was calculated. When aggregating indicator values some scientists use equal weights for all components (Andriessen and Stam, 2005; Hervas-Oliver and Dalmau-Porta, 2007; Lin and Edvinsson, 2011; Stam and Andriessen, 2009), others use expert evaluation to determine weights (Beskese et al., 2014; Bontis, 2004; Buračas et al., 2012; Užienė, 2014). Expert evaluation fits best once the number of evaluated objects is not high, but when the number of evaluated object increases it becomes more difficult for experts to accurately evaluate each of them (Ginevičius, 2005). Usually the number of indicators used to measure the components of national intellectual capital is high, and expert evaluation might not be able to accurately reveal the importance of each indicator. The authors suggest to use refined methods of factor scores calculation in this aggregation level as a solution to this problem. Refined methods allow to calculate factor scores as a linear combination of the observed variables, which consider what is shared between the item and the factor and what is not measured (DiStefano et al., 2009). This method does not use any underlying model to predict the factor score but reflects the extent, to which the factor or component estimated is manifested by each individual case. Non-refined factor scores computation methods should be used only in order to aggregate small number of factors defined by refined factor scores computation methods. In this stage usually it is known small number of factors related with specific construct. To evaluate those factors importance to national intellectual capital perfectly fits expert evaluation method.

2.1 National intellectual capital measurement model

In this article a national intellectual capital measurement model is proposed, which combines two value aggregation functions depending on the level of aggregation. Firstly, the value of national intellectual capital components was calculated from initial indicators as regression scores using the factor analysis procedure. Regression factor scores reflect the location of each country on the factor. This method was chosen as it helps to maximize the validity of the calculated factor scores. The calculated values of national intellectual capital components are standardized values, which have zero mean and unit variance. Secondly, the values of national intellectual components were aggregated using the SAW method. If indicators selected to measure structural part of national intellectual capital fall into several factors per factor analysis procedure, their values are summarized using SAW method applying equal factor scores. Later aggregation function is applied based on structural model of national intellectual capital. In this level of aggregation only four factors of national intellectual capital are defined. In order to define each of these factor weights we used direct expert evaluation. 21 experts from Lithuania, Latvia and Czech Republic were chosen, who evaluated the weight of each national intellectual component. Evaluation was performed in April of 2016. The calculated Kendall's coefficient of concordance is W=0.358, and this value is statistically significant with a level of significance of 0.01. This shows that the experts displayed a significant agreement of components' weights, and their evaluations can be considered as reliable.

Based on the results of the expert evaluation the national intellectual aggregation function is composed (refer with: Eq 1)

$$NIC = 0{,}22SC + 0{,}28STC + 0{,}32HC + 0{,}18RC \quad (1)$$

where NIC denotes national intellectual capital; SC is social capital, STC is structural capital, HC is human capital, and RC is relational capital. The highest weight was given to human capital and the lowest one to relational capital. The calculated Cronbach alpha score for defined components equals 0.859 and is above the threshold of 0.7 (Nunnally, 1978). This shows that the composed measurement model is reliable.

The national intellectual capital measurement model is composed of 28 indicators. These indicators were chosen based on literature review and data availability. After the first selection was made an indicator system was optimized by performing a factorial analysis. Only indicators that had a low level of correlation (less than 0.8) were kept. If indicators had a higher correlation one of them was removed from the measurement model.

Human capital is measured using education-based approach. Most popular indicators of human capital in this approach are average years of schooling, school enrolment rates, adult literacy rates and quality of schooling indicators (Le et al., 2005). After factor analysis of human capital indicators two factors was identified. First one covers quality of education indicators such as: student performance in reading (PISA), high-level computer skills, lifelong learning and satisfaction of education. Second one consist with education attainment related indicators: population with upper secondary or tertiary education attainment, participation rate of young people in education and high level internet skills.

Structural capital is measured with eight indicators: EPO patent applications, USPTO patent applications, community trade mark applications, share of innovative enterprises, fixed broadband coverage, percentage of households with internet access, enterprises with internet access and total R&D personnel and researchers.

Relational capital is measured with ten indicators forming two factors. Openness of a country factor is measured with seven indicators: foreign direct investment intensity, students (ISCED 5-6) studying in another EU-27, inflow of students (ISCED 5-6) from EU-27, EEA and Candidate countries - as % of all students in the country, foreign country citizens immigration per population, emigration rate, enterprises engaged in any type of innovation co-operation with a partner in all other countries except in EU countries EFTA or EU candidates countries, United States, China or India and exports of goods and services in % of GDP. Intensity of technology transfer factor contains two indicators: high-technology exports, enterprises engaged in any type of innovation co-operation with a partner in all other countries except in EU countries.

Social capital is measured with three indicators: level of institutions, satisfaction with the national government, general trust. Such measurement gives view not only to level of informal social interactions but also is able to assess level of institutional environment in a country. General trust level in society is measured according Akçomak and ter Weel (2009), Knack an Keefer (1997) recommendations to combine answers to three ESS survey questions.

Measurement scale of all indicators is comparable between counties. If indicator initially is measured in absolute scale, before any calculations it is transformed into relative value based on population of each country. One of advanced features of suggested measurement model is that it does not include input indicators (expenditures on development of intellectual capital elements). Including input indicators together with outcome indicators is criticized due to lack of construct validity (Malhotra, 2003). National intellectual capital inputs may not be valid 'proxies' for outcomes, since efficiency of inputs are not evaluated.

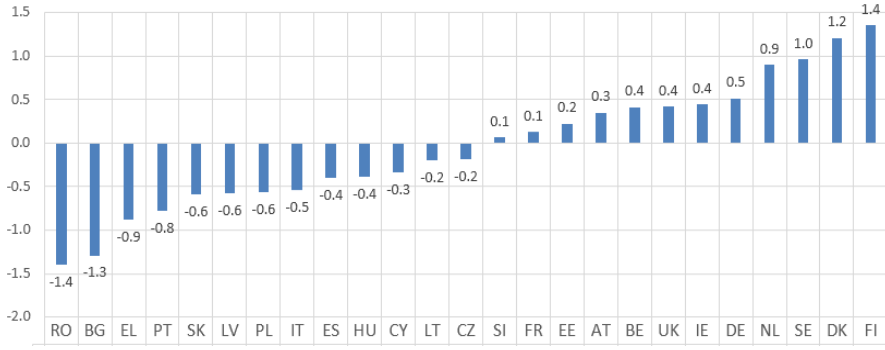
Data for this research is obtained from the Eurostat database, the World Data Bank, the World Economic Forum database, the European Social Survey database, OECD (PISA survey results), USPTO and EPO was the source of data on patent applications. The data panel had 9.92% of missing values, which were imputed using the multiple imputation procedure: predictive mean matching (PMM). This procedure was applied for the data of each country separately so the country's values were not influenced by other countries' indicator values.

The value of national intellectual capital was calculated in 25 EU countries from 2002 to 2012. Three EU countries (Croatia, Malta and Luxembourg) were not included in the analysis due to a lack of statistical data of defined indicators of national intellectual capital. These countries are small in size and have very specific factors concerning their economies, so their exclusion from analysis could be justified.

3. NATIONAL INTELLECTUAL CAPITAL VALUE IN EU COUNTRIES IN 2002-2012

The calculated value of national intellectual capital is expressed in Z scores, where the average value equals zero, values above average are positive, and below average values are negative. The average value of national intellectual capital in EU countries during 2002-2012 is shown in Figure 2.

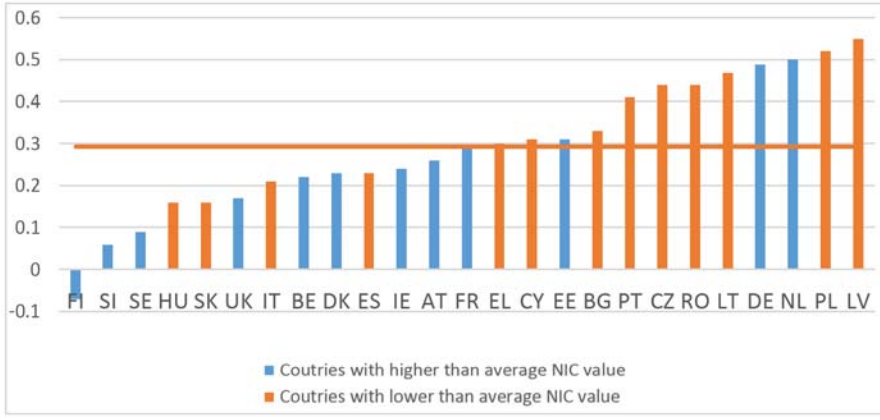
Figure 2. National intellectual capital value in EU countries in 2002-2012



Source: Authors' estimation.

The results have shown that the highest level of national intellectual capital was in Finland, Denmark, and Sweden. The lowest level of national intellectual capital was in Romania, Bulgaria, and Greece. Changes of the level of national intellectual capital during the period 2002-2012 are shown in Figure 3.

Figure 3. National intellectual capital value change in EU countries during 2002-2012



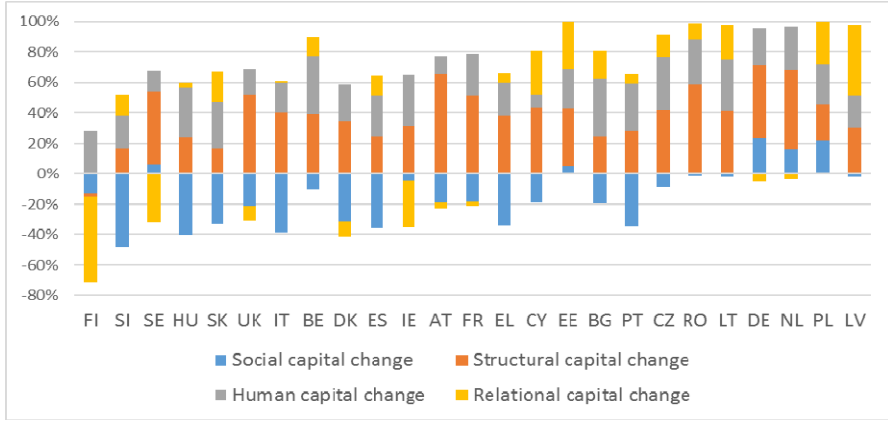
Source: Authors' estimation.

The level of national intellectual capital has increased in all evaluated countries except Finland. Finland has the highest level of national intellectual capital, but this level is not increasing further. In Figure 3 countries are divided into two groups depending on their average level of national intellectual capital. Countries with a higher than average national intellectual capital value level are marked in blue and countries with lower than average national intellectual capital value level are marked in orange. This allows to graphically see how the level of national

intellectual capital relates to the change of this level during 2002-2012. It could be seen that the change of national intellectual capital was above average in nine countries, which initially had a lower level of national intellectual capital, and in only three countries, which initially had a higher level of national intellectual capital. To test if there is a relation between the change of national intellectual capital during 2002-2012 and the initial level of national intellectual capital in 2002 a correlation coefficient between these two variables was calculated. The results have shown that the correlation coefficient between these variables equals -0.401, and it is statistically significant with the significance level of 0.05. The negative sign of the correlation coefficient indicates that in the countries with a higher level of intellectual capital this level increased less than in the countries with a lower level of national intellectual capital. Such trend shows signs of convergence of national intellectual capital between EU countries.

The factors that compose the change of the level of national intellectual capital during 2002-2012 are shown in Figure 4. In this figure countries are ranked depending on the volume of the change of national intellectual capital from the lowest to the highest.

Figure 4. National intellectual capital value change in EU countries during 2002-2012



Source: Authors' estimation.

It can be seen that the level of human capital increased in all analysed countries. Almost the same trend applies for structural capital, which increased in all countries except Finland. These two factors determined the increase of the value of national intellectual capital value in many countries during this period. It can be noticed that the level of social capital was decreasing in many countries, and this slowed down the total increase of national intellectual capital in many countries.

Also a decrease of relational capital is measured in several countries. This decrease is very visible in Finland. In this country the decrease of relational capital was the highest comparing with the decrease of other national intellectual capital components. More detailed research is needed to explain the reasons of such a decrease.

CONCLUSIONS

The importance of national intellectual capital is widely recognized, though its conceptual models are still developing. Several structural models are used to explain this concept. Most of these models were developed for the business level of research and later directly applied to

analyse intellectual capital on the national level. These models define a different number of structural components and use specific terms to describe them. However, these differences are most visible once defining components of non-human intellectual capital. Human capital is excluded in all models as a structural component of intellectual capital. One of the models developed especially for national intellectual capital research is the national intellectual capital model of Kapyla et.al. (2012). This model consists of four components: human capital, structural capital, relational capital, and social capital. When comparing it with other national intellectual capital models this model incorporates the concept of social capital, which is widely recognized and helps to explain internal relational environment of countries better than the broad structural capital concept used in other models. Based on Kapyla et.al. (2012) a structural model of evaluation of national intellectual capital was proposed.

The analysis of models of national intellectual capital measurement has revealed that the main weakness of current measurement models is subjectivity arising in selecting measurement indicators and value aggregation functions. In order to reduce the subjectivity arising in the value aggregation process the authors suggest to combine two indicators values aggregation functions refined methods of factor scores calculation should be used when aggregating indicators values into factor scores. In the next level factor scores could be aggregated using the non-refined method of SAW, though the importance of each factor to the final value of national intellectual capital needs to be evaluated by experts. Such strategy of national intellectual capital value aggregation allows to increase the reliability of measurements.

The proposed national intellectual capital measurement model was used to evaluate national intellectual capital in EU countries during the period of 2002-2012. During this period the level of national intellectual capital increased in all analysed EU countries except Finland. The main source of this growth was an increasing level of human capital and structural capital. However, the level of social capital decreased in many analysed countries and influenced a lower growth of the total level of national intellectual capital. When analysing the dependence of the initial level of national intellectual capital on its growth volume it was recognized that national intellectual capital increased more in countries, which had a lower level of national intellectual capital in the beginning of the period (2002-2012). This means that national intellectual capital converges between EU countries. The speed of the change of national intellectual capital is different in all countries. Only absolute levels of change were identified in this article, and the sources of this change need to be investigated further by applying the case analysis method.

REFERENCES

Akçomak, İ.S., ter Weel, B. (2009), "Social capital, innovation and growth: Evidence from Europe. European", *Economic Review*, Vol. 53, No. 5, pp. 544–567.

Andriessen, D., Stam, C.D. (2005), "Intellectual capital of the European Union", *McOaster World Congress on the Management of Intellectual Capital and Innovation*, pp. 19–21.

Anskaitis, A., Bareišis, V., Lydeka Z. (2006), "Constructivist and Analytical Approach to Intellectual Capital", *Engineering Economics*, Vol. 49, No. 4, pp. 63-68

Agénor, P.-R., Dinh, H.T. (2013), "Social capital, product imitation and growth with learning externalities", *World Bank Policy Research Working Paper*, No. 6607, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2327363

Balcerzak, A.P. (2016), "Technological Potential of European Economy. Proposition of Measurement with Application of Multiple Criteria Decision Analysis", *Montenegrin Journal of Economics*, Vol. 12, No. 3, pp. 7–17.

Batog B., Batog J. (2015), "Conditional Income Convergence in the European Union: R&D Spending and Export Influence", *Transformations in Business and Economics,* Vol. 14, No. 3c(36c), pp. 407-418.

Beskese, A., Bozbura, F.T., Aldemir, G. (2014), "A Model Proposal to Measure National Intellectual Capital", *18th International Research/Expert Conference "Trends in the Development of Machinery and Associated Technology" TMT 2014,* Budapest, pp. 193–197.

Beslerová S., Dzuričková J. (2014), "Quality of Life Measurements in EU Countries" in *Enterprise and the Competitive Environment 2014 Conference Procedia Economics and Finance*, Vol. 12, pp. 37-47.

Bontis, N. (2004), "National Intellectual Capital Index: A United Nations initiative for the Arab region", *Journal of Intellectual Capital*, Vol. 5, No. 1, pp. 13–39.

Bornemann M. (2012), "Intelligent growth", *Journal of Organisational Transformation & Social Change*, Vol. 9, Iss. 2, pp. 175-183.

Buračas, A. (2007), "The competetiveness of the EU in context of the intellectual capital development" *Intellectual economics*, No. 1, pp. 18–28.

Buračas, A., Lopes, I.T., Žvirblis, A. (2012), *Metaeconomics Approach and Intellectual Resources Evaluation*, LAP Lambert Academic Publishing.

Bruneckiene J., Cincikaite R., Kilijoniene A. (2012), "The Specifics of Measurement the Urban Competitiveness at the National and International Level", *Engineering Economics*, Vol. 23, No. 3, pp. 256-270.

DiStefano, C., Zhu, M., Mindrila, D. (2009), "Understanding and using factor scores: Considerations for the applied researcher", *Practical Assessment, Research & Evaluation*, Vol. 14, No. 20, pp. 1–11.

Erumban, A.A., Das, D.K. (2016), "Information and communication technology and economic growth in India". *Telecommunications Policy*, No. *40*(5), pp. 412–431.

Dumay, J., Garanina, T. (2013), "Intellectual capital research: a critical examination of the third stage", *Journal of Intellectual Capital*, Vol. 14 No. 1, pp. 10–25.

Ginevičius, R. (2005), "Daugiakriterinio vertinimo rodiklių svorių nustatymas, remiantis jų tarpusavio sąveika", *Verslas: Teorija Ir Praktika*, Vol. 7 No. 1, pp. 3–13.

Grootaert, C., Van Bastelaer, T., Putnam, R.D. sud. (2008), "*The role of social capital in development: an empirical assessment*", Cambridge University Press, Cambridge.

Hall, B.H., Lerner, J. (2010), "The financing of R&D and innovation", *The Handbook of Technology and Innovation Management*, No. 1, pp. 609–639.

Hervas-Oliver, J.L., Dalmau-Porta, J.I. (2007), "Which IC components explain national IC stocks?", *Journal of Intellectual Capital*, Vol. 8, No. 3, pp. 444–469.

Jianbin, C., Yanli, G., Kaibo, X. (2014), "Value Added from Knowledge Collaboration: Convergence of Intellectual Capital and Social Capital", *International Journal of U- & E-Service, Science & Technology*, Vol. 7, No. 2, pp. 15–26.

Kapyla, J., Kujansivu, P., Lönnqvist, A. (2012), "National intellectual capital performance: a strategic approach", *Journal of Intellectual Capital*, Vol. 13 No. 3, pp. 343–362.

Keller, W. (2009), "International Trade, Foreign Direct Investment, and Technology Spillovers" *National Bureau of Economic Research,* Working Paper, No. 15442, available at: http:// www.nber.org/papers/w15442

Knack, S., Keefer, P. (1997), "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation", *The Quarterly Journal of Economics*, Vol. 112, No 4, pp. 1251–1288.

Krušinskas, R., Bruneckienė, J. (2015), "Measurement of intellectual capital of Lithuanian cities by a composite index", *Journal of Business Economics and Management*, Vol. 16, No. 3, pp. 529–541.

Koch, G. (2011), "What Cannot Be Measured Can Nevertheless Be Managed", in Jeschke, S., Isenhardt, I., Hees, F., Trantow, S. (Eds.), *Enabling Innovation*, Springer Berlin Heidelberg, pp. 349–353.

Lahovnik M., Breznik L. (2014), "Technological Innovation Capabilities as a Source of Competitive Advantage: a Case Study from the Home Appliance Industry", *Transformation in Business & Economics*, Vol. 13, No. 2(32), pp. 144-160.

Le, T., Gibson, J., Oxley, L. (2005), "Measures of human capital: A review of the literature" *New Zealand Treasury Working Paper Series*, No. 05/10. available at: https://ideas.repec.org/p/nzt/nztwps/05-10.html

Lin, C.Y.-Y., Edvinsson, L. (2011), *National Intellectual Capital a Comparison of 40 Countries*, Springer, New York.

Malhotra, Y. (2000), "Knowledge Assets in the Global Economy: Assessment of National Intellectual Capital", *Journal of Global Information Management*, No. 8(3), pp. 5–15.

Malhotra, Y. (2003), "Measuring Knowledge Assets of a Nation: Knowledge Systems for Development", *United Nations Advisory Meeting of the Department of Economic and Social Affairs Division for Public Administration and Development Management*, available at: http://km.brint.com/KnowledgeManagementMeasurementResearch.pdf (accessed 26 March 2014).

Nunnally, J.C. (1978), *Psychometric Theory*, McGraw-Hill.

Pilinkus, D., Neimontaite A., (2013), "Building Leading Economic Index: a Case of Lithuania", *Transformations in Business and Economics,* Vol. 12, No. 1(28), pp. 163-181.

Pulic, A. (2004), "Intellectual capital – does it create or destroy value?", *Measuring Business Excellence*, No. 8(1), pp. 62–68.

Rakauskienė O.G., Lisauskaitė V. (2009), "Quality of Life of the Population of Lithuania: the Conception,Development and Prospects", *Ekonomika: mokslo darbai.*, T. 88, pp. 106–129.

Salonius, H., Lönnqvist, A. (2012), "Exploring the policy relevance of national intellectual capital information", *Journal of Intellectual Capital*, Vol. 13, No. 3, pp. 331–342.

Serenko, A., Bontis, N., Booker, L., Sadeddin, K., Hardie, T. (2010), "A scientometric analysis of knowledge management and intellectual capital academic literature (1994-2008)", *Journal of Knowledge Management*, 14(1), Vol. 23, No. 3, pp. 3-23.

Stahle, P., Stahle, S., Lin, C.Y.Y. (2015), "Intangibles and national economic wealth – a new perspective on how they are linked", *Journal of Intellectual Capital*, Vol. 16, No. 1, pp. 20–57.

Stam, C., Andriessen, D. (2009), "Intellectual Capital of the European Union 2008: Measuring the Lisbon Strategy for Growth and Jobs", *Electronic Journal of Knowledge Management*, Vol. 7, No. 4, pp. 489-500.

Stewart, T.A. (1997), *Intellectual Capital: The New Wealth of Organizations*, Currency, Doubleday.

Tabellini, G. (2010), "Culture and Institutions: Economic Development in the Regions of Europe". *Journal of the European Economic Association*, Vol. 8, No. 4, pp. 677–716.

Taranenko I. (2013), "Strategic Analysis of Innovation-Based Competitiveness in the Global Economy" *Montenegrin Journal of Economics*, Vol. 9, No. 1, pp.127-133.

Gižienė, V., Simanavičienė, Ž. (2012), "Žmogiškojo kapitalo vertinimo koncepcija", *Business systems and economics*, No. 2, pp. 116-133.

Užienė, L. (2014), "Measurement of National Intellectual Capital: The Benchmarking of the Baltic Countries in the Context of Europe.", *Proceedings of the European Conference on Intellectual Capital*, Trnava, Slovak Republic, pp. 283–292.

Užienė, L. (2010), "Model of Organization's Intellectual Capital Measurement", *Engineering Economics*, Vol. 21, No. 2, pp. 151-159

Vu, K.M. (2011), „ICT as a source of economic growth in the information age: Empirical evidence from the 1996–2005 period", *Telecommunications Policy*, No. 35(4), pp. 357–372.